

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark
Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 26 January 1999 (26.01.99)	
International application No. PCT/SE98/00970	Applicant's or agent's file reference TP 1239
International filing date (day/month/year) 22 May 1998 (22.05.98)	Priority date (day/month/year) 29 May 1997 (29.05.97)
Applicant ANDERSSON, Thorbjörn et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
15 December 1998 (15.12.98)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Mougamadou Abidine
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference TP 1239	<div style="display: flex; justify-content: space-between;"> <div style="width: 40%;"> FOR FURTHER ACTION </div> <div style="width: 60%; font-size: small;"> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. </div> </div>	
International application No. PCT/SE 98/00970	International filing date (<i>day/month/year</i>) 22 May 1998	(Earliest) Priority Date (<i>day/month/year</i>) 29 May 1997
Applicant Tetra Laval Holdings & Finance S.A. et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (See Box I).

2. ☐ Unity of invention is lacking (See Box II).

3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing

☐ filed with the international application.
☐ furnished by the applicant separately from the international application,

☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.

☐ transcribed by this Authority.

4. With regard to the title, ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:

Figure No. 1

☐ as suggested by the applicant.

☐ None of the figures.

☒ because the applicant failed to suggest a figure.
☐ because this figure better characterizes the invention.

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ SE

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only		
Identification of IPEA		Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference TP 1239
International application No. PCT/SE98/00970	International filing date (day/month/year) 22-05-1998	(Earliest) Priority date (day/month/year) 29-05-1997
Title of invention An extruded/blow moulded bottle, as well as a method and material for producing the bottle		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) TETRA LAVAL HOLDINGS & FINANCE S A Av. Général-Guisan 70 CH-1009 PULLY Switzerland		Telephone No.: 41 21729 22 11 Facsimile No.: 41 217 29 27 59 Teleprinter No.: 041 2145 58 11
State (that is, country) of nationality: CH		State (that is, country) of residence: Switzerland
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) Andersson, Thorbjörn Assarhusavägen 56 S-240 17 S:a Sandby, Sweden		
State (that is, country) of nationality: SE		State (that is, country) of residence: Sweden
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) Andrén, Sven Älgskyttevägen 19 S-226 53 LUND, Sweden		
State (that is, country) of nationality: SE		State (that is, country) of residence: Sweden
<input checked="" type="checkbox"/> Further applicants are indicated on a continuation sheet.		

Continuation of Box No. II APPLICANT(S)

If none of the following sub-boxes is used, this sheet should not be included in the demand.

Name and address: (Familyname followed by givenname; for a legal entity, full official designation. The address must include postal code and name of country.)

Bentmar, Mats
Hästhovsgatan 8
S-233 37 SVEDALA, Sweden

State (that is, country) of nationality:

SE

State (that is, country) of residence:

Sweden

Name and address: (Familyname followed by givenname; for a legal entity, full official designation. The address must include postal code and name of country.)

Dalholm, Patrik
Styrbjörn Starkes gränd 6
S-224 77 Lund, Sweden

State (that is, country) of nationality:

SE

State (that is, country) of residence:

Sweden

Name and address: (Familyname followed by givenname; for a legal entity, full official designation. The address must include postal code and name of country.)

Oveby, Claes
Nils Anders väg 27
S-232 51 ÅKARP, Sweden

State (that is, country) of nationality:

SE

State (that is, country) of residence:

Sweden

Name and address: (Familyname followed by givenname; for a legal entity, full official designation. The address must include postal code and name of country.)

Wallén, Göran
Stationsgatan 13
S-244 63 KÄVLINGE, Sweden

State (that is, country) of nationality:

SE

State (that is, country) of residence:

Sweden



Further applicants are indicated on another continuation sheet.

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*Sundell, Håkan
AB TETRA PAK
Ruben Rausings gata
S-221 86 LUND, Sweden

Telephone No.:

046-36 22 97

Facsimile No.:

046-13 79 23

Teleprinter No.:

32140 TPLUND

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filed

the description

☐ as originally filed☐ as amended under Article 34

the claims

☐ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34

the drawings

☐ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination:

☐ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (<i>specify</i>) | : | sheets |

For International Preliminary Examining Authority use only

received not received

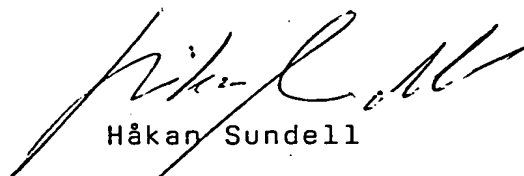
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (<i>specify</i>): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).


Håkan Sundell

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

International application No PCT/SE98/00970	For International Preliminary Examining Authority use only
Applicant's or agent's file reference TP 1239	Date stamp of the IPEA
Applicant <div style="text-align: center; font-weight: bold; margin-top: 10px;">TETRA LAVAL HOLDINGS & FINANCE S A</div>	
Calculation of prescribed fees	
1. Preliminary examination fee	<div style="border: 1px solid black; display: inline-block; padding: 2px 10px;">4.200:-</div> <div style="border: 1px solid black; display: inline-block; padding: 2px 5px; margin-left: 5px;">P</div>
2. Handling fee <i>(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)</i>	<div style="border: 1px solid black; display: inline-block; padding: 2px 10px;">1.250:-</div> <div style="border: 1px solid black; display: inline-block; padding: 2px 5px; margin-left: 5px;">H</div>
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	<div style="border: 1px solid black; display: inline-block; padding: 2px 10px; margin-bottom: 5px;">5.450:-</div> <div style="border: 1px solid black; display: inline-block; padding: 2px 10px;">TOTAL</div>
Mode of Payment	
<input checked="" type="checkbox"/> authorization to charge deposit account with the IPEA (see below)	<input type="checkbox"/> cash
<input type="checkbox"/> cheque	<input type="checkbox"/> revenue stamps
<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons
<input type="checkbox"/> bank draft	<input type="checkbox"/> other (specify):
Deposit Account Authorization <i>(this mode of payment may not be available at all IPEAs)</i> The IPEA/ <u>SE</u> <input checked="" type="checkbox"/> is hereby authorized to charge the total fees indicated above to my deposit account. <input type="checkbox"/> <i>(this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)</i> is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.	
<u>164020</u> Deposit Account Number	<u>14 December 1998</u> Date (day/month/year)
<div style="text-align: right;"> Signature Håkan Sundell </div>	

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

WRITTEN OPINION

(PCT Rule 66)

990712

To:

Sundell, Håkan
AB TETRA PAK
Ruben Rausings gata
S-221 86 Lund, Sweden

Date of mailing (day/month/year)	28 -05- 1999
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Applicant's or agent's file reference TP 1239		REPLY DUE within 45 days from the above date of mailing
International application No. PCT/SE98/00970	International filing date (day/month/year) 22.05.1998	Priority date (day/month/year) 29.05.1997
International Patent Classification (IPC) or both national classification and IPC ₆ B32 B 1/02, B32B 5/18, B65D 1/02, B29C 44/04, B29C 49/04, C08J 9/08		
Applicant Tetra Laval Holdings & Finance S.A. et al		

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
 - I ☒ Basis of the report
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application
3. The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 29.09.1999

Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Monika Bohlin/Els Telephone No. 08-782 25 00
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WRITTEN OPINION

International application No.

PCT/SE98/00970

I. Basis of the report

1. This opinion has been drawn on the basis of *(Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".)*:

- ☒ the international application as originally filed.
- ☐ the description, pages _____, as originally filed,
 pages _____, filed with the demand,
 pages _____, filed with the letter of _____.
- ☐ the claims, Nos. _____, as originally filed,
 Nos. _____, as amended under Article 19,
 Nos. _____, filed with the demand,
 Nos. _____, filed with the letter of _____.
- ☐ the drawings, sheets/fig _____, as originally filed,
 sheets/fig _____, filed with the demand
 sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/fig _____

3. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

WRITTEN OPINION

International application No.

PCT/SE98/00970

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>3, 8, 10-11</u>	YES
	Claims	<u>1-2, 4-7, 9, 12-13</u>	NO
Inventive step (IS)	Claims	<u></u>	YES
	Claims	<u>1-13</u>	NO
Industrial applicability (IA)	Claims	<u>1-13</u>	YES
	Claims	<u></u>	NO

2. Citations and explanations

The claimed invention relates to an extruded/blow-moulded bottle or container. In order to reduce the bottle weight and the material consumption, the bottle comprises a layer of foamed plastic material, surrounded by outer, solid layers of the same type of material. The foamed plastic material is a blend of a rigid polymer component, which forms the skeleton or interstices in the foamed wall structure, and a ductile or soft polymer component, which forms a skin or cell wall between the skeleton and interstices.

The following documents have been cited in the search report:

D1 DE1504359 A
D2 GB 2097403 A
D3 EP 0575809 A2
D4 DE 19525198 A1

D1 discloses a blow-moulded container having a foamed wall structure with outer, rigid skin layers. The material can be a blend of high impact (ductile) polystyrene (50%) and normal, crystalline (rigid) polystyrene (50%). The blowing agent can be citric acid.

D2 discloses a foamed polyethylene film, produced in a film blowing process. The material is preferably a blend of high-density, crystalline (rigid) polyethylene and a low-density (ductile) polyethylene. Films with improved mechanical properties could be produced using this polymer composition.

.../...

WRITTEN OPINION

International application No.

PCT/SE98/00970

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V

D3 discloses a polyolefin composition comprising a rigid component (polypropylene) and a ductile component, the latter being a core-shell graft copolymer prepared from a crosslinked rubber-like polymer and a monomer. The composition has good processability, and products made thereof have excellent impact resistance, rigidity and surface appearance. The polyolefin composition can be used to produce bottles with a foamed wall structure (see examples 26-29).

Finally, D4 discloses a blow moulding process for the production of a foamed bottle. According to this document, an outer, rigid skin layer can be formed by coextrusion.

The subject matter of claims 1-2, 4-7, 9 and 12-13 does not differ from the disclosure of D1. Thus, these claims are considered to lack novelty.

D3 teaches the use of a polyolefin composition comprising a rigid component and a ductile component, for the production of foamed articles, for example bottles. D2 teaches the use of high-density polyethylene as a rigid component, and low-density polyethylene as a ductile component, for the production of blown, foamed films. It is considered obvious to a person skilled in the art, to combine the teachings of D2 and D3, and thus use the composition of D2 for the production of foamed, blow moulded bottles. Therefore, claims 3 and 8 are considered to lack inventive step. Further, the subject matter of claims 10-11 is considered obvious to a person skilled in the art, in view of the disclosure of D4. Therefore, these claims are considered to lack inventive step.

The claimed invention is considered to be industrially applicable.

09/423207



AB Tetra Pak

PATENT DEPARTMENT

420 Rec'd PCT/PTO 3 NOV 1999

Patent- och Registreringsverket
Box 5055
102 42 STOCKHOLM

Your reference
PCT/SE98/00970

Our reference
TP 1239-WO

Date
6 July, 1999

International Patent Application No. PCT/SE98/00970

In view of the communication (first written opinion) dated 28th May, 1999 we submit herewith a set of new claims along with our following observations in connection with the above-identified international application.

New claim 1 corresponds essentially to previous claims 1-3, except for the added new feature that all layers are manufactured through a coextrusion process, as stated on last line in the characterizing portion of new claim 1. This new feature is supported by the specification on page 6, lines 27-32.

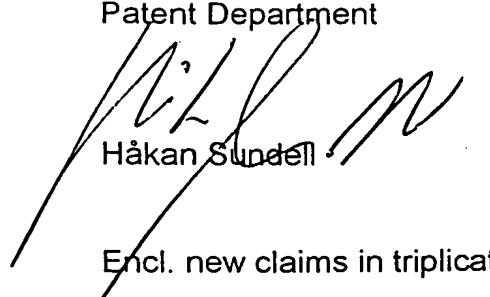
New claims 2-4 correspond to previous claims 4-6.

None of the cited and discussed documents in said communication, taken alone or in any combination with each other, discloses an extruded/blow moulded bottle having the unique combination of features as set forth in new claim 1, and none of them can therefore be deemed to constitute a bar against novelty and/or inventive level of the bottle in new claim 1.

We therefore look forward to receiving a favourable preliminary examination report on basis of the new claims as submitted herewith.

Yours sincerely

AB TETRA PAK
Patent Department



Håkan Sundell

Encl. new claims in triplicate

AB Tetra Pak

Ruben Rausing's gata, S-221 86 Lund, Sweden
Telephone +46 46 36 10 00, Telefax +46 46 13 79 23
Reg. No.: 556050-0398

Replacement sheet

Claims

1. An extruded/blow moulded bottle having an extruded wall structure (10) comprising an intermediate layer (11) of foamed plastic and outer, solid layers (12 and 13) of plastic, **characterized in that** the plastic of the foamed intermediate layer (11) is a mixture of a first, rigid polymer component being selected from the group essentially comprising high density polyethylene and high melt-strength polypropylene, and a second ductile (soft) polymer component being selected from the group essentially comprising low density polyethylene and polypropylene for general purposes, that said plastic of the outer, solid layers (12 and 13) is of the same type as said rigid polymer component of the foamed intermediate layer (11), and in that all layers (11,12,13) are produced through a coextrusion process.
2. The extruded/blow moulded bottle as claimed in claim 1, **characterized in that** the mixing ratio of the first, rigid polymer component to the second, ductile (soft) polymer component in the foamed plastic layer (11) is between 1:3 and 3:1.
3. The extruded/blow moulded bottle as claimed in any of claims 1 and 2, **characterized in that** the central, foamed plastic layer (11) takes up between 50 and 100% of the total weight of the wall material, while the two outer, surrounding plastic layers (12 and 13) together take up between 0 and 50% of the total weight of the wall material.
4. The extruded/blow moulded bottle as claimed in any of claims 1-3, **characterized in that** the two outer, surrounding layers (12 and 13) display substantially the same layer thicknesses.



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B32B 1/02, 5/18, B65D 1/02, B29C 44/04, 49/04, C08J 9/08	A1	(11) International Publication Number: WO 98/53986 (43) International Publication Date: 3 December 1998 (03.12.98)
(21) International Application Number: PCT/SE98/00970 (22) International Filing Date: 22 May 1998 (22.05.98) (30) Priority Data: 9702026-7 29 May 1997 (29.05.97) SE (71) Applicant (for all designated States except US): TETRA LAVAL HOLDINGS & FINANCE S.A. [CH/CH]; Avenue Général-Guisan 70, CH-1009 Pully (CH). (72) Inventors; and (75) Inventors/Applicants (for US only): ANDERSSON, Thorbjörn [SE/SE]; Assarhusavägen 56, S-240 17 Sandby (SE). ANDREN, Sven [SE/SE]; Älgskyttevägen 19, S-226 53 Lund (SE). BENTMAR, Mats [SE/SE]; Hästhovsgatan 8, S-233 37 Svedala (SE). DALHOLM, Patrik [SE/SE]; Styrbjörn Starkes gränd 6, S-224 77 Lund (SE). OVEBY, Claes [SE/SE]; Nils Anders väg 27, S-232 51 Åkarp (SE). WALLEN, Göran [SE/SE]; Stationsgatan 13, S-244 63 Kävlinge (SE). (74) Agent: SUNDELL, Håkan; AB Tetra Pak, Ruben Rausing's gata, S-221 86 Lund (SE).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: AN EXTRUDED/BLOW MOULDED BOTTLE, AS WELL AS A METHOD AND MATERIAL FOR PRODUCING THE BOTTLE		
(57) Abstract <p>An extruded/blow moulded bottle, together with a process for producing the bottle. The bottle has a wall structure (10) comprising a layer (11) of foamed plastic material which is surrounded by outer, solid layers (12 and 13) of plastic of the same type as the plastic in the foamed layer (11). The material in the foamed layer (11) includes a rigid polymer component and a ductile polymer component in a mixing ratio of from 1:3 to 3:1, and in addition the foamed layer (11) constitutes at least 50% of the total weight of the bottle. The bottle is produced by a combined extrusion/blow moulding process in which granulate starting material including the two polymer components and a chemical CO₂-generating blowing agent is melted and, under excess pressure, is forced through an annular nozzle during simultaneous expansion of the formed CO₂ blisters. The formed, foamed hose is accommodated in a mould cavity and inflated with the aid of air at high pressure to the desired bottle configuration.</p> <div data-bbox="617 1218 1429 1575"> </div>		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
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AN EXTRUDED/BLOW MOULDED BOTTLE, AS WELL AS A METHOD AND MATERIAL FOR PRODUCING THE BOTTLE

TECHNICAL FIELD

5 The present invention relates to a bottle or similar container which is produced by a combined extrusion/blow moulding process. The present invention also relates to an extrusion/blow moulding process, together with a granulate starting material for the production of said bottle or similar container.

10

BACKGROUND ART

Bottles and similar containers of plastic are conventionally produced by a combined extrusion/blow moulding process in which granulate starting material of plastic is fed into a screw/cylinder apparatus together with other additives selected for the container production process. By means of the rotating screw fitted with helical blade, the starting material is advanced through the cylinder at the same time as it is melted and the above-mentioned additives are distributed and thoroughly mixed throughout the entire molten plastic mass. The molten, homogeneous plastic mass is pressed through a tool (nozzle) which is disposed at the front end of the apparatus and is provided with an annular aperture for forming a tube or hose. The extruded hose is inserted into and accommodated by a mould cavity formed by moving mould halves, whereafter the hose end thus accommodated between the mould halves is cut and inflated to the inner walls of the mould cavity by means of a blowpipe which is inserted in the hose and is in valve-regulated communication with a source of high pressure air. The compressed air communication is broken and the mould halves are separated from one another for removing the extruded/blow moulded container whose geometric outer configuration exactly corresponds with the configuration defined by the inner walls of the mould cavity.

30 In the above-described method, for example bottles of high density polyethylene (HDPE) are produced for milk and similar liquid foods. With the aid of modern, high speed filling machines, the freshly produced, empty bottles are filled with the pertinent contents, whereafter the filled bottles are sealed by means of a suitable sealing agent or capsule device which is applied in liquid-tight fashion on the bottle over the open bottle neck. Filled

bottles discharged from the filling machine are thereafter collected in stacks or groups suitable for distribution, for further transport out to a sale or consumption point for the packed product.

5 While the handling of the filled bottles takes place by machine as far as this is at all possible, there nevertheless occur occasions when the bottles or bottle groups must be handled manually as in, for example, certain reloading and relocation operations.

10 A serious drawback inherent in the prior art extruded/blow moulded bottles of high density polyethylene (HDPE) is that they are excessively, but of necessity, relatively thick-walled and therefore unnecessarily heavy and unwieldy to handle manually. The relatively large wall thickness is, on the other hand, necessary in order that the requisite mechanical strength and rigidity be imparted to the bottle, and such mechanical strength and rigidity deteriorates dramatically and becomes insufficient if the wall thickness of the
15 bottle is less than a minimum value which, at least to some extent, is determined by the relevant bottle shape. In addition to its excessive, but necessary wall thickness, the prior art extruded/blow moulded bottle consumes an unnecessary amount of material and is, therefore, costly in production.

20

OBJECTS OF THE INVENTION

One object of the present invention is thus to obviate the above-described drawbacks inherent in the prior art technology.

25 A further object of the present invention is to realise an extruded/blow moulded bottle of plastic with greatly reduced material weight, but maintained desired superior mechanical strength and rigidity in order to be able to be handled easily and conveniently.

30 These and other objects and advantages will be attained according to the present invention as a result of the extruded/blow moulded bottle as defined in independent Claim 1.

Further expedient embodiments of the bottle according to the present invention have moreover been given the characterizing features as set forth in appended subclaims 2 to 6.

35 A further object of the present invention is to realise a combined extrusion/blow moulding operation for producing such weight-reduced, mechanically strong and rigid plastic bottles. This object has been attained

according to the present invention by means of the process as defined in independent Claim 7. Expedient embodiments of the process according to the present invention have further been given the characterizing features as set forth in appended subclaims 8 to 11.

- 5 Yet a further object of the present invention is to realise a suitable starting material of plastic for producing the extruded/blow moulded bottle. This object is attained according to the present invention by means of the granulate plastic material as defined in independent Claim 12.

10 OUTLINE OF THE INVENTION

- The material in the foamed intermediate layer in the extruded/blow moulded plastic bottle should thus consist of a mixture of a first rigid polymer component and a second, soft (ductile) polymer component, of which the first, rigid component forms the skeleton or interstices in the
15 foamed wall layer structure, while the second, soft (ductile) polymer component forms a skin or cell wall between the above-mentioned skeleton or interstices, respectively. Preferably, the rigid and ductile (soft) polymer components are of the same polymer type.

- Examples of such rigid polymer components which have proved to be
20 usable in the foamed intermediate layer material in the extruded/blow moulded plastic bottle according to the present invention may be high density polyethylene (HDPE), high melt-strength polypropylene (HMS PP), etc., while examples of such ductile (soft) polymer components which have proved to be usable in the foamed intermediate layer material may be low
25 density polyethylene (LDPE), polypropylene for general purposes (GP PP), etc.

- A particularly preferred combination of rigid polymer component and ductile (soft) polymer component is, according to the present invention, low density polyethylene (LDPE) and high density polyethylene (HDPE) in
30 which the mixing ratio of LDPE to HDPE is 1:3-3:1 based on weight. Optimum results concerning the weight and rigidity in the extruded/blow moulded plastic bottle according to the invention are achieved when the mixing ratio of LDPE to HDPE is 1.5:1.

- The rigid, skeleton-forming polymer component in the foamed
35 intermediate layer in the extruded/blow moulded plastic bottle according to the present invention may also be defined as a polymer component which

has a high crystallisation degree (high crystalline), high density, few short chain branches per 1000 C atoms and no long chain branches at all. Correspondingly, the ductile (soft) polymer component may be defined as a polymer component which has low crystallisation degree (low crystalline),
5 low density, many short chain branches per 1000 C atoms and also long chain branches. Concerning the rigid polymer component of HDPE, this implies a density in the range of 950-970 and a melt index in the range of 0.5-1.5, while, for the ductile (soft) polymer component of LDPE, this implies a density in the range of 915-922 and a melt index in the range of 4.5-8.5.

10 The chemical blowing agent with which the mixture of the rigid and ductile (soft) polymer components is to be expanded or foamed may, according to the present invention, be sodium hydrocarbonate and/or citric acid, preferably a mixture of these two blowing agents in stoichiometric proportions. The total quantity of blowing agent which is employed in the
15 production of an extruded/blow moulded plastic bottle by the method according to the present invention may vary from approx. 0.5 to approx. 2.5% of the total weight of the mixture.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWING

20 The present invention will now be described in greater detail hereinbelow with the aid of a preferred but non-restrictive Example and with reference to the accompanying Drawing which schematically illustrates a cross section of a wall material of an extruded/blow moulded plastic bottle according to the present invention.

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DESCRIPTION OF PREFERRED EMBODIMENT

According to the preferred embodiment which is shown schematically on the accompanying Drawing, the wall material carrying the generic reference numeral 10 comprises, in an extruded/blow moulded plastic
30 bottle, a central layer 11 and two outer skin layers 12 and 13 on both sides of the central layer 11.

The material in the central, foamed layer 11 consists, as was mentioned above, of a mixture of a first rigid polymer component and a second ductile (soft) polymer component which, in the relevant
35 embodiment, is an HDPE component and an LDPE component, respectively, of which the HDPE component has a density in the range of 950-970 and a

5 melt index in the range of 0.1-1.5, while, correspondingly, the LDPE component has a density in the range of 915-922 and a melt index in the range of 4.5-8.5. The mixing ratio between the two polymer components (i.e. LDPE:HDPE) should be between 1:3 and 3:1, preferably 1.5:1, in order to give optimum results as regards rigidity/thickness of the produced plastic bottle.

10 The two outer wall layers 12 and 13 may be the same or different, but are preferably the same and produced from a polymer possessing a high modulus of elasticity, for example HDPE, whereby high strength and rigidity will be attained as a result of the so-called I-beam effect, as will be well-known to a person skilled in the art.

The relative thicknesses of the central, foamed wall layer 11 and the two outer homogeneous wall layers 12 and 13 are preferably such that the central, foamed wall layers 11 takes up approx. 50-100% of the total weight of the wall material, while the two outer, homogeneous layers 12 and 13 together constitute approx. 0-50% of the total weight of the wall material.

15 A bottle for packing and transporting liquid foods, for example milk, for refrigerated distribution is produced according to the present invention by means of a combined (co-)extrusion/blow moulding process comprising a first (co-)extrusion step and a subsequent, second blow moulding step.

20 Granulate starting material containing, i) a first rigid polymer component, preferably HDPE, ii) a second ductile (soft) polymer component (LDPE) and iii) a chemical blowing agent, preferably sodium hydrocarbonate and/or citric acid, is fed into a screw/cylinder apparatus through a replenishment hopper disposed at the rear end of the apparatus. The ratio between the components included in the granulate starting material is such that the ratio of the ductile (soft) LDPE component to the rigid HDPE component lies within the range of 1:3-3:1, preferably 1.25:1. The quantity of the chemical blowing agent should be 0.5-2.5% of the total weight of the granulate starting material. The infed granulate starting material is subjected to high temperature in an infeed zone of the screw/cylinder apparatus in which the free area between the walls of the cylinder and the screw core is minimised in order to create superior mixing conditions for the infed components in the starting material and, at the same time as the starting material is heated to such an elevated temperature that the chemical blowing agent (sodium hydrocarbonate and citric acid) is decomposed for the

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formation of carbon dioxide and sodium hydrocarbonate and citric acid residues acting as nucleation seats in the molten plastic mass.

5 The molten, homogeneously mixed plastic starting material is advanced by the rotating screw fitted with helical blades from the infeed zone to a further compression zone, at the same time as the starting material is cooled for the formation of a cool homogeneous mixture under a pressure of between 200 and 300 bar excess pressure. At this high pressure, the released carbon dioxide is converted into overcritical state.

10 The cooled, pressurised plastic melt is thereafter forced out through a tool (nozzle) which is disposed at the front end of the screw/cylinder apparatus and is provided with an annular nozzle aperture, for the formation of a hose at the same time as the overcritical carbon dioxide instantaneously expands at the pressure transition from the above- mentioned excess pressure of 200-300 bar to normal atmospheric pressure, 15 for the formation of the foamed wall layer structure.

The extruded, foamed hose of LDPE/HDPE is introduced into the region between two movable mould halves which are brought together for the formation of a mould cavity in which the hose is accommodated. The hose accommodated in the mould cavity is cut and the two mould halves are 20 transferred to a mould blowing station in which the hose portion accommodated between the mould halves is inflated, by means of a blowpipe inserted into the hose, towards the inner walls in the mould cavity defined by the mould halves. Thereafter, the mould halves are separated from one another for removing (or stripping) the blow moulded bottle 25 whose geometric outer configuration thus substantially corresponds to the inner mould cavity configuration.

In an alternative embodiment, the above-mentioned screw/cylinder apparatus may be supplemented with at least one additional screw/cylinder apparatus connected to the same common tool for co-extrusion of solid 30 (dense) outer layers 12 and 13, as shown on the Drawing. Such a wall structure affords an extremely high mechanical strength and rigidity at very low material consumption seen as a whole.

In the above-described method according to the present invention, extruded/blow moulded plastic bottles may be produced with a nominal : 35 inner volume of 1l. with the same or comparable rigidity and strength as a

conventional bottle produced from HDPE, but with up to 30% less material consumption.

The present invention should not be considered as restricted to that described above and shown on the Drawing, many modifications being
5 conceivable without departing from the scope of the appended Claims.

WHAT IS CLAIMED IS:

1. An extruded/blow moulded bottle, characterized in that it has a wall structure (10) comprising a layer (11) of foamed plastic material of a first, rigid polymer component and a second, ductile (soft) polymer component.
2. The extruded/blow moulded bottle as claimed in Claim 1, characterized in that the foamed layer (11) is surrounded by outer, solid layers (12 and 13) of plastic of the same type as said first, rigid polymer component in the foamed central plastic layer (11).
3. The extruded/blow moulded bottle as claimed in Claim 1 or 2, characterized in that the first, rigid polymer component is selected from the group essentially comprising high density polyethylene and high melt-strength polypropylene; and that the second, ductile (soft) polymer component has been selected from the group essentially comprising low density polyethylene and polypropylene for general purposes, said first and said second polymer components being of the same polymer type.
4. The extruded/blow moulded bottle as claimed in any of the preceding Claims, characterized in that the mixing ratio of the first, rigid polymer component to the second, ductile (soft) polymer component in the foamed plastic layer (11) is between 1:3 and 3:1.
5. The extruded/blow moulded bottle as claimed in any of Claims 2 to 4, characterized in that the central, foamed plastic layer (11) takes up between 50 and 100% of the total weight of the wall material, while the two outer, surrounding plastic layers (12 and 13) together take up between 0 and 50% of the total weight of the wall material.
6. The extruded/blow moulded bottle as claimed in any of Claims 2 to 5, characterized in that the two outer, surrounding layers (12 and 13) display substantially the same layer thicknesses.
7. A process for producing an extruded/blow moulded bottle as claimed Claims 1, characterized in that a granulate plastic material

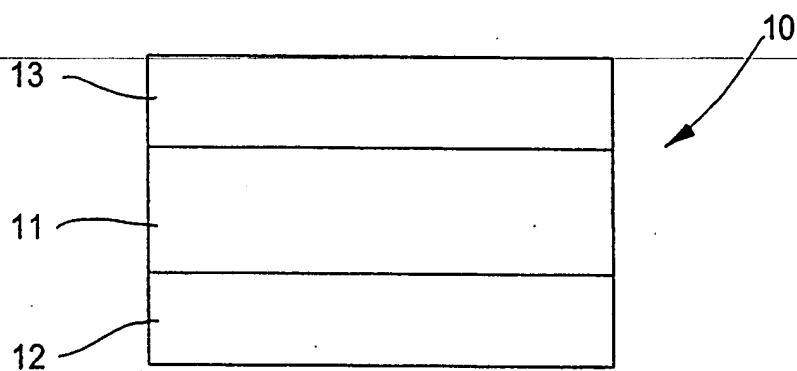
comprising a first, rigid polymer component, a second, ductile (soft) polymer component and a chemical, carbon dioxide-generating blowing agent is carefully mixed during simultaneous heating for decomposition of the chemical blowing agent for the formation of a molten plastic mass with
5 homogeneously distributed carbon dioxide blisters; that the thus molten, carbon dioxide-containing plastic mass is compressed to an excess pressure in the range of between 300 and 400 atmospheres during simultaneous cooling for converting the carbon dioxide blisters into an overcritical state; that the compressed, cooled plastic melt is forced through an annular nozzle
10 aperture during simultaneous expansion of the overcritical carbon dioxide blisters for the formation of a hose of foamed structure; that the foamed hose is accommodated in a mould cavity formed between moving mould halves whose inner defining walls determine the geometric outer configuration of the finished bottle; that the hose accommodated in the mould cavity is
15 inflated by means of a blowpipe at least partly inserted into the hose and in communication with a source of high pressure air; and that the hose thus inflated against the inner walls of the mould cavity is removed from the mould cavity for the formation of the extruded/blow moulded bottle displaying foamed wall structure.

20 8. The process as claimed in Claim 7, characterized in that the first, rigid polymer component is selected from the group essentially comprising high density polyethylene and high melt-strength polypropylene; that the second, ductile polymer component is selected from the group essentially
25 comprising low density polyethylene and polypropylene for general purposes; and that the mixing ratio between the first, rigid polymer component and the second, ductile (soft) polymer component is set in the region between 1:3 and 3:1.

30 9. The process as claimed in Claim 7 or 8, characterized in that the chemical, carbon dioxide-generating blowing agent is selected from the group essentially comprising sodium hydrocarbonate, citric acid and mixtures thereof; and that the quantity of blowing agent is approx. 0.5-2.5% of the total weight of the mixture.

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10. The process as claimed in any of Claims 7 to 9, characterized in that the molten, cooled plastic mass is forced through the annular nozzle aperture at the same time as molten, homogeneous polymer, by a co-extrusion process, is forced through corresponding, annular nozzle apertures
5 for the formation of the surrounding outer layer of the foamed central hose layer.
11. The process as claimed in Claim 10, characterized in that the homogeneous polymer for the two surrounding outer layers consists of a
10 rigid polymer of the same type as the rigid polymer component in the foamed central hose layer.
12. A granulate plastic material for carrying out the process as claimed in Claim 7, characterized in that it includes a first, rigid polymer component, a
15 second, ductile (soft) polymer component and a chemical, carbon dioxide-generating blowing agent, the mixing ratio between the first, rigid polymer component and the second, ductile (soft) polymer component is between 1:3 and 3:1 based on weight, and the quantity of the chemical carbon dioxide-generating blowing agent is approx. 0.5-2.5% of the total weight of the
20 mixture.
13. The granulate plastic material as claimed in Claim 12, characterized in that the chemical carbon dioxide-generating blowing agent has been selected from the group essentially comprising sodium hydrocarbonate,
25 citric acid or mixtures thereof.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/00970

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B32B 1/02, B32B 5/18, B65D 1/02, B29C 44/04, B29C 49/04, C08J 9/08
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B29C, B32B, C08J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	--	3-6,8-11
X	GB 2097403 A (BXL PLASTICS LIMITED), 3 November 1982 (03.11.82), page 1, line 31 - line 35; page 1, line 58 - page 2, line 6, examples 1-2, claim 1, part B, abstract	12-13
Y	--	3-6,9

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

10 Sept 1998

Date of mailing of the international search report

14 -09- 1998

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/00970

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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